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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/786,452

02/24/2004

Charles L. Tilton

ISR-172

4914

7590

03/22/2007

Paul A. Knight
2218 North Molter Road
Liberty Lake, WA 99019

EXAMINER

DUONG, THO V

ART UNIT

PAPER NUMBER

3744

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

03/22/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/786,452

Applicant(s)

TILTON ET AL.

Examiner

Tho v. Duong

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3744

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 December 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17, 19-31 and 35-44 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17, 19-31 and 35-44 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 April 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 2/8/05.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Receipt of applicant's amendment filed 12/21/06 is acknowledged. Claims 1-17, 19-31 and 35-44 are pending.

Election/Restrictions

Applicant's election without traverse of group I in the reply filed on 12/21/06 is acknowledged.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the claimed subject matter of "an array of etched microchannels" must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet"

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pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1-2,4,5 and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Kobrinetz et al. (US 5,768,103). Kobrinetz discloses (figure 3, column 1, line 27-47 and column 3, line 7- column 4, line 32) a spray cooling system comprising a cooling surface with a hotspot zone (22) producing a high heat flux; a sprayer of atomizer type (60) in a spaced apart relationship to the hotspot zone and capable of transforming a supply of liquid coolant into a continuous pattern of droplets that impinge and create a thin coolant film generally within the hotspot zone; and wherein the thin coolant film cools the hotspot zone primarily through evaporation; a vapor management protrusion (36) surrounding the sprayer. Regarding claim 2, an electronic device such as a die is capable of producing a heat flux of greater than 300 Watts/cm². (See Chrysler 6,650,542, column 3, line 38-40 as evidence).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kobrinetz in view of Burward- Hoy (US 6,029,742). Kobrinetz discloses substantially all of applicant's claimed invention as discussed above except for the limitation that the hotspot zone includes an array of etched microchannels. Burward discloses (figure 8) an impinging cooling system that has a hotspot zone (282) further includes an array of microchannels for a purpose of increasing the efficiency of heat transfer from the hotspot zone and the fluid. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use Burwar-Hoy's teaching in Kobrinet's device for a purpose of increasing the efficiency of heat transfer from the hotspot zone and the fluid.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kobrinetz in view of Kieda et al. (US 5,021,924). Kobrinetz substantially discloses all of applicant's claimed invention as discussed above except for the limitation that the sprayer is at a non-perpendicular angle to the cooling surface. Kieda discloses (figure 6) a chip cooling system that has the sprayer (4) angled from the cooling surface for a purpose reducing the pressure that the fluid

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exerting on the chip. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use Kieda's teaching in Kobrinetz's device for a purpose of reducing the pressure that the fluid exerting on the chip.

Claims 1-2,4,7,8-11,15-17,19,23-26,29,31,35 and 37-44 are rejected under 35

U.S.C. 102(a) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Patel et al. (US 6,612,120). Patel discloses (figures 3, 4 and column 5, lines 25-54) a spray cooling system comprising a cooling surface with a hotspot zone (121) producing a high heat flux; a sprayer in a spaced apart relationship to the hotspot zone and capable of transforming a supply a liquid coolant into a continuous pattern of droplets that impinge and create a thin coolant film generally within the hotspot zone (121); a vapor management protrusion (103) surrounding the sprayer; a secondary incremental drop ejector for adding the fluid to a non-hotspot regions (123,125). Regarding the limitation of how much heat flux is generated, applicant discloses that a chip is capable of generating more than 300 Watts/cm² in one region and under 100 watts/cm in other regions. Since Patel's electronic device is also a chip, it should be capable of generating a similar heat flux. Furthermore, an electronic device such as a die is capable of producing a heat flux of greater than 300 Watts/cm² in its hottest region and under 100Watts/cm² in other cache regions when the other region is not active. (See Chrysler 6,650,542, column 3, line 38-40 as evidence). Regarding the limitation of a hydraulic jump and a thin cooling film at the impingement point and a radially thicker film on the cooling surface, this phenomena is an inherently phenomena that is resulted from an impingement cooling including a sprayer in a spaced distance spraying a jet on a cooling surface. This inherently phenomena can be seen from having water running down on the sink from the faucet. The hydraulic jump and the

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phenomena of impingement cooling on a chip are also described in IBM Technical Disclosure Bulletin (figure 1). In view of the above inherently phenomena, Patel's cooling system is considered to read on the claimed invention since as the sprayer (105) sprays on the hottest region (121). Consequently, a thinner film will be formed at the point of impingement, and a thicker film is radially formed on the non-hot spot regions (123,125).

Claims 3,12,20,27 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patel in view of Burward- Hoy (US 6,029,742). Patel discloses substantially all of applicant's claimed invention as discussed above except for the limitation that the hotspot zone includes an array of etched microchannels. Burward discloses (figure 8) an impinging cooling system that has a hotspot zone (282) further includes an array of microchannels for a purpose of increasing the efficiency of heat transfer from the hotspot zone and the fluid. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use Burwar-Hoy's teaching in Patel's device for a purpose of increasing the efficiency of heat transfer from the hotspot zone and the fluid.

Claims 6,13,21 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patel in view of Kieda et al. (US 5,021,924). Patel substantially discloses all of applicant's claimed invention as discussed above except for the limitation that the sprayer is at a non-perpendicular angle to the cooling surface. Kieda discloses (figure 6) a chip cooling system that has the sprayer (4) angled from the cooling surface for a purpose reducing the pressure that the fluid exerting on the chip. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use Kieda's teaching in Patel's device for a purpose of reducing the pressure that the fluid exerting on the chip.

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Claims 5,14,22 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patel in view of Kobrinetz (US 5,768,103). Patel discloses substantially all of applicant's claimed invention as discussed above except for the limitation that the sprayer is an atomizer type sprayer. Kobrinetz discloses (figure 3, column 3, lines 44-52 and column 4, lines 16-23) a chip impingement chip cooling system that has the sprayer (60) is atomizer type sprayer for a purpose of atomizing the fluid for a purpose of enhancing the evaporation of the fluid upon impingement. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use Kobrinetz's teaching in Patel's device for a purpose of enhancing the evaporation of the fluid upon impingement.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Cole et al. (US 6,498,725) discloses a method and two phase spray cooling apparatus.

Tilton et al. (US 5,220,804) discloses a high heat flux evaporative spray cooling.

Budelman (US 6,349,760) discloses an apparatus for improving the thermal performance of heat sink.

Anderson et al. (US 5,412,536) discloses a local condensation control for liquid impingement.

Tilton et al. (US 2004/0060313A1) discloses a thermal management system.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tho v. Duong whose telephone number is 571-272-4793. The examiner can normally be reached on M-F.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tyler J. Cheryl can be reached on 571-272-4834. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TD



Tho v Duong
Primary Examiner
Art Unit 3744

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March 15, 2007